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Economic Impact of Palifermin on the Costs of Hospitalization for Autologous Hematopoietic Stem-Cell Transplant: Analysis of Phase 3 Trial Results

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ABSTRACT

A double-blind, randomized trial showed that, compared with placebo, palifermin (recombinant human keratinocyte growth factor) reduced the frequency and duration of oral mucositis in patients with hematologic malignancies undergoing high-dose chemotherapy and total-body irradiation with autologous stem-cell support. This previously published study also showed a significant reduction in the incidence of adverse subsequent outcomes. The objective of this study was to estimate the impact of palifermin prophylaxis on hospital costs of transplantation in the trial. This was a retrospective, economic analysis of estimated costs for a previously published clinical trial. Costs were not collected during the trial. Therefore, we estimated the direct medical costs of hospitalization using hospital charges from similar patients' hospitalization charges selected from the National Inpatient Sample, a population-based, nationally representative sample of hospital claims. Costs were estimated from charges using Medicare's state-specific cost-to-charge ratios. These cost estimates were applied to the outcome data (incidence of febrile neutropenia, bacteremia/fungemia, or pneumonia, and use of total parenteral nutrition) from the clinical trial. Patients were those with hematologic malignancies who received high-dose chemotherapy and total-body irradiation with autologous stem cell transplant. We compared the estimated total hospital costs (in 2005 United States dollars) incurred by patients who received palifermin in the clinical trial with those incurred by patients who received placebo. Costs were analyzed from the provider's perspective. The mean cost of a hospital day in this population varied between $2,834, when no adverse outcomes occurred, and $4,663, when all 4 outcomes occurred. Reductions in adverse outcomes and their associated hospital stay offset the acquisition price of palifermin. A nonsignificant mean savings of $3,595 per patient (95% confidence interval: $2,090-$5,103) was observed. In sensitivity analyses, this observation was robust to all plausible values of per diem hospital costs and hypothetic per diem outpatient costs. In addition to its previously demonstrated clinical benefit, palifermin prophylaxis offers a favorable economic profile among patients with hematologic malignancies who receive total body irradiation and autologous stem cell support.

KEY WORDS

Palifermin • Stem cell transplant • Economic analysis • Cost of illness • Cancer

INTRODUCTION

Oral mucositis (OM) is a frequent and often severe complication in patients who are treated with hematopoietic stem cell transplantation (HSCT). A higher incidence rate of OM is associated with conditioning regimens that include total-body irradiation (TBI) in combination with high-dose chemotherapy than when chemotherapy is used alone [1]. Because of the toxicity of high-dose, myeloablative

chemotherapy, the condition can be especially debilitating for patients with hematologic malignancies who undergo HSCT [2]. A number of studies have demonstrated that approximately 75% of all patients who receive HSCT experience severe OM (grades 3 and 4) [3-6]. In this setting, the condition is associated with significantly poorer clinical outcomes, such as febrile neutropenia (FN), bacteremia, and prolonged use of total parenteral nutrition (TPN). In addition, the costs associated with OM can be excessive because of increased utilization of antibiotics, pain medication, TPN, and longer hospital stays [2-7]. In a multinational pilot study, Sonis et al. [2] reported that hospital charges among HSCT recipients with OM were nearly $43,000 higher than patients who did not experience the condition.

Recently, palifermin (recombinant human keratinocyte growth factor, Kepivance [Amgen, Thousand Oaks, CA]) was approved based in part on a randomized, double-blind, placebo-controlled clinical trial that showed significant reductions in the incidence and duration of severe OM in patients with hematologic malignancies who received myelotoxic therapy including TBI and HSCT [8]. In this trial by Spielberger et al. [8], palifermin was also associated with a significant reduction in the incidence of important subsequent outcomes (FN, use of TPN, and blood borne infections), decreased opioid analgesic use, and a 2-day reduction in the average length of hospital stay [9]. In addition, palifermin significantly reduced the incidence of the World Health Organization (WHO) grade 4 OM (20% vs 62%, $p < 0.001$), which is associated with increased resource utilization. A recent, non randomized study, conducted in patients with hematologic cancers undergoing HSCT without TBI confirmed these findings; the incidence of severe mucositis and the length of hospitalization were significantly lower among patients who received palifermin compared with historic controls [10].

We hypothesized that the significant reductions in hospitalization associated with costly subsequent outcomes among patients treated with palifermin might offset the acquisition cost of the drug or lead to cost savings. Cost data were not collected during the randomized trial, but the consistency in the frequency of important subsequent outcomes (particularly FN, infections, and TPN use) in the trial and in previous studies suggested a method for estimating cost. Therefore, we conducted a retrospective cost analysis of palifermin in the transplant setting, combining outcome data from the previously published clinical trial and cost data from a nationally representative database.

PATIENTS AND METHODS

Data were obtained from 2 sources. Length of stay and clinical outcomes were obtained from the phase 3 trial [8]. Because costs were not collected prospectively during the clinical trial and were not available retrospectively, the cost of hospital days was estimated from the National Inpatient Survey (NIS) and applied to the patients in the clinical trial.

The phase 3 trial included 212 patients with hematologic cancers. One hundred six patients were randomly assigned to receive intravenous palifermin (60 μg per kilogram of body weight per day) for 3 consecutive days before receiving TBI and high-dose chemotherapy and for 3 days after infusion of autologous stem cells. The other 106 patients followed the same conditioning and transplantation protocol but were randomly assigned to receive placebo intravenously [8].

The NIS is a random sample of claims from hospital discharges in the United States, weighted to be representative of the hospitals and population [10]. It is the largest collection of encounter-level, all-payer hospital cost and care data in the United States. The NIS database includes discharges from all public and private hospitals, except federal and military centers, in 38 participating states. Reporting of all discharges is legislatively mandated in these states and discharges are evaluated at both hospital and patient levels to ensure that the entire country is represented. The NIS was created as part of the Healthcare Cost and Utilization Project. It is publicly available through the Agency for Healthcare Research and Quality and has been used extensively to study the cost and quality of hospital care in the United States [11].

Analytic Strategy

We compared the average cost of hospitalization of the patients who received palifermin to the average cost of those who received placebo. To ensure that the costs obtained from the NIS reflected the care delivered to the trial patients as closely as possible, we matched the NIS cohort to the trial patients on hematologic malignancy, type of cells received, use of TBI, and presence or absence of subsequent outcomes as follows.

First, we classified each patient in the trial by treatment strategy (palifermin versus placebo) and by presence or absence of subsequent outcomes of OM (none, FN, TPN, bacteremia, pneumonia, and combinations of outcomes) (Table 1). Blood borne infections were defined a priori in the original trial's protocol and collected prospectively as secondary outcomes. In the original publication they were reported as a single outcome. However, we categorized individual outcomes to apply more

Table 1. *Adverse Clinical Outcomes**

Outcome	Palifermin N = 106		Placebo N = 106	
	No. (%) Affected	Length of Stay Mean Days (SD)	No. (%) Affected	Length of Stay Mean Days (SD)
None	13 (12)	19.85 (7.83)	3 (3)	15.00 (12.00)
FN only	52 (49)	20.50 (8.36)	38 (36)	19.84 (10.17)
TPN only	10 (9)	22.00 (3.92)	5 (4)	22.20 (3.11)
BACT only	1 (1)	11.00 (—)	0	—
PN only	1 (1)	10.00 (—)	0	—
TPN + FN	18 (17)[a]	22.11 (7.14)	36 (34)†	24.0 (5.26)
TPN + BACT	2 (2)	24.50 (2.12)	1 (1)	28.00 (—)
FN + BACT	3 (3)	18.33 (6.43)	3 (3)	16.67 (14.98)
FN + PN	3 (3)	28.33 (6.66)	4 (4)	27.50 (6.86)
TPN, FN, BACT	3 (3)	24.33 (5.86)	12 (11)	25.75 (8.01)
TPN, FN, PN	0	—	3 (3)	26.00 (6.08)
TPN, FN, BACT, PN	0	—	1 (1)	22.00 (—)

FN indicates febrile neutropenia; TPN, total parenteral nutrition; BACT, bacteremia or fungemia; PN, pneumonia; SD, standard deviation.
*Outcomes derived from clinical trial [8,17].
†$P = .005$.

precise costs from the NIS. As a result of this process, we analyzed culture-proved bacteremia/fungemia and pneumonia separately. We did not categorize 5 episodes of "blood-borne infection" owing to lack of information from case report forms. These patients were categorized by their other outcomes as follows. On the palifermin arm, 2 cases with coagulase negative Staphylococci, but without positive blood cultures or a site of infection, were categorized by their other outcomes, FN in 1 case and both FN and TPN in the other. Also on the palifermin arm, 1 case of "sepsis" without positive blood cultures was classified as FN. On the placebo arm, 1 case of "sepsis" without positive blood cultures was classified as FN and TPN, and 1 case of "bacterial infection" without a positive blood culture and without an organism was classified as FN.

Next, we selected patients with hematologic malignancies who underwent autologous HSCT after TBI during the same years that the clinical trial was conducted (2001-2002) from the NIS database using appropriate diagnosis and procedure codes (Table 2). We classified these patients by the same outcomes used to classify the clinical trial patients (none, FN, TPN, bacteremia, pneumonia, and combinations of outcomes), again using appropriate diagnosis or procedure codes. The cost of hospitalization was computed from this sample.

We assumed the perspective of the hospital (provider) for this analysis; thus, the cost of providing care was of more interest than the charges billed. The NIS database includes charges, not costs. Therefore, we obtained charges from the NIS based on the outcomes, and transformed them into costs using state-specific Medicare cost-to-charge ratios for operating and capital costs for urban centers [12]. These costs were adjusted to 2005 US dollars using the Consumer Price Index for hospital services in urban areas, where most bone marrow transplants are performed [13]. From this final estimate, the mean cost per hospital day was computed for each outcome group (none, FN, TPN, bacteremia, pneumonia, and combinations of outcomes).

We computed the estimates of cost for the patients in the clinical trial by multiplying the mean cost per hospital day (from the NIS patients) by the number of hospital days for each trial patient, matched on outcome group. For trial patients who received palifermin, we added the average sales price of palifermin ($8,250 per patient per 6-day course), which we ob-

Table 2. *Codes Used to Identify Patient and Treatment Groups and Clinical Outcomes in the National Inpatient Sample (NIS)*

Group	Category	ICD 9 Codes	NIS Data Type
Malignancy	Hematologic	196.x, 200.2x, 201.xx-208.xx, V10.6x, V10.7x, 238.7	Diagnosis
Transplant type	Autologous	41.00, 41.01, 41.04, 41.07, 41.09	Procedure
Transplanted cells	Stem cells	41.04, 41.07, 41.05, 41.08	Procedure
Conditioning	Total body irradiation	92.24, 92.26, 92.77, 92.29	Procedure
Outcomes	Febrile neutropenia	288.0	Diagnosis
	Total parenteral nutrition	99.15	Procedure
	Bacteremia, Fungemia	038.xx, 112.5, 117.9	Diagnosis
	Pneumonia	480.xx-487.0	Diagnosis

tained from the Centers for Medicare and Medicaid Services [14].

We assumed that costs were distributed evenly across the entire hospital stay and that all providers would pay the average sales price for palifermin.

Analyses

We described the mean total costs and 95% confidence limits for patients who received palifermin or placebo and described differences in total costs using linear regression. Standard errors were bootstrapped to reduce the effect of extreme values of cost. Sensitivity analyses, in the form of best-case and worst-case scenarios, were conducted based on the 95% confidence limits around the mean total cost of hospitalization (also known as the Box method).

No data were available on the outpatient costs of HSCT after TBI. Therefore, our primary analysis included only the inpatient costs. Because some patients in the clinical trial were managed for all or part of their transplant in the outpatient setting, our primary results reflect neither the total cost of transplant nor the difference in total cost of care between palifermin and placebo. However, we conducted 2 sensitivity analyses using hypothetic outpatient costs. For both analyses, we constructed a hypothetic 35-day observation time for each patient, approximating the treatment schema in the trial. We computed the number of outpatient days by subtracting the number of hospital days from 35. In the first analysis, we assigned outpatient per diem costs as a percentage of each patient's inpatient per diem costs, reflecting the outcomes and intensity of care required by each patient while in the hospital. In the second analysis, we assigned identical hypothetic per diem outpatient costs, ranging from $500-$3,000, to every patient. We then computed hypothetic total costs by summing estimated inpatient costs and hypothetic outpatient costs. In both analyses, ranges of plausible and extreme values were examined.

Differences between proportions were described using 2-tailed chi-square tests. Differences in the mean length of stays for patients on palifermin and placebo were described using 2-tailed *t*-tests.

The study was reviewed by the institutional review board at The University of Texas M.D. Anderson Cancer Center and determined to be exempt as it used only deidentified or public use datasets.

RESULTS

The 212 patients in the clinical trial were very similar to the 877 patients in the NIS population. The distribution of age and gender was virtually identical in the NIS cohort and clinical trial patients, but non-Hispanic whites were more common in the trial population (Table 3). Because some trial patients were transplanted in the outpatient setting, the mean length of hospital stay was shorter in the clinical trial patients (22.8 days) than in the NIS sample (26.6 days). Because of our selection criteria, the NIS data included only those patients who received their transplants in the hospital. The trial and NIS databases did not share a common measure of severity of illness. However the 2 groups were similar with respect to 2 related factors; 82% of trial patients had excellent performance status (≥90%) and 84% of NIS patients had no comorbid illnesses. Patients with non-Hodgkin's lymphoma and multiple myeloma predominated in both the trial (75.9%) and the NIS (70.6%) groups. However, multiple myeloma patients were overrepresented in the NIS population compared with the trial population (35% versus 9%).

Table 3. *Comparison of Characteristics of Patients in Clinical Trial and National Inpatient Sample (NIS)*

Characteristic	Clinical Trial N = 212	National Inpatient Sample N = 877
Age, mean years (95% CI)	46.4 (44.7-47.9)	47.6 (44.0-51.3)
Males, % (95% CI)	62 (55-68)	62 (56-67)
Non-Hispanic White, % (95% CI)	79 (73-84)	63 (50-76)
African-American, % (95% CI)	8 (5-13)	5 (1-10)
Hispanic, % (95% CI)	8 (5-13)	10 (0-21)
Asian, others, % (95% CI)	4 (2-8)	4 (0-8)
Unknown, % (95% CI)	0	18 (4-31)
Charlson comorbidity score* = 0	—	83.9 (78.4-88.2)
Charlson comorbidity score ≥1	—	16.1 (11.8-21.6)
Karnofsky Performance status** ≥90	82.1 (76.2-87.0)	—
Karnofsky Performance status <90	17.9 (13.0-23.8)	—
Hospital stay, mean days (95% CI)	21.7 (20.6-22.8)	26.6 (21.8-31.4)

CI indicates confidence interval.
*Lower scores indicate fewer comorbid conditions [21].
**Higher scores indicate better performance status [22].

Based on the NIS data, the national mean cost per hospital day for patients with hematologic malignancies undergoing HSCT ranged from $2,834 (95% confidence interval [CI] = $2,255-$3,413), in the case where no subsequent outcomes were present, to $4,663 (95% CI = $2,341-$6,985), in the case where multiple outcomes occurred, reflecting higher intensity of services when multiple outcomes occurred. Longer hospitalizations were associated with multiple adverse subsequent outcomes in the clinical trial patients as well. Most trial patients who had short hospitalizations (<2 weeks) had 0 or 1 subsequent outcomes, whereas those with long hospitalizations

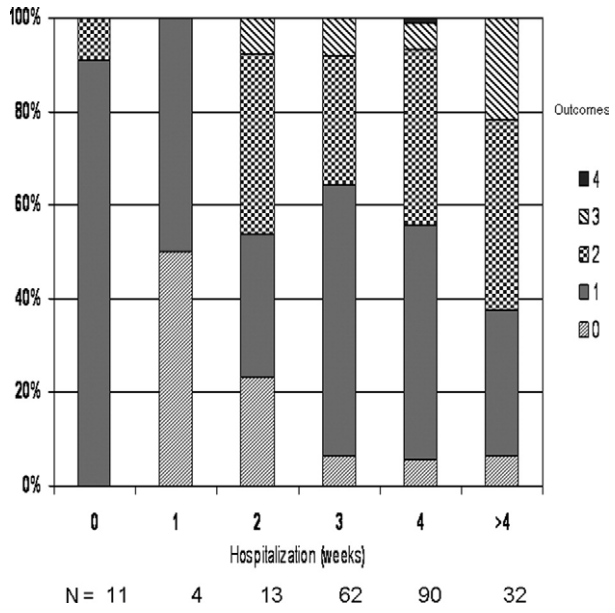

Figure 1. Relationship between duration of hospitalization and number of adverse outcomes. Adverse outcomes include febrile neutropenia, bacteremia, pneumonia, and total parenteral nutrition.

tended to have several adverse outcomes (Figure 1) Five patients on the palifermin arm and 6 on the placebo arm were never admitted to the hospital. Among those who were admitted to the hospital, the mean hospital length of stays differed between those on palifermin (22.0 days; 95% CI = 20.8-23.2 days) and placebo (23.7 days; 95% CI = 22.4-25.0; $P = .06$). Twelve percent of patients on the palifermin arm and only 5% of patients on the placebo arm were admitted for <2 weeks.

The estimated average total cost per patient for those treated with palifermin in the clinical trial was $73,938 (95% CI = $69,031-$78,845) versus $77,533 (95% CI = $71,121-$83,948) for patients who received placebo (Figure 2) This analysis demonstrated a modest savings of $3,595 per patient treated with palifermin, after accounting for the acquisition cost of palifermin. However, it is important to note that the difference in mean costs was not statistically significant ($P = .39$), suggesting that although the addition of palifermin may not increase cost, it may not reduce costs either. Inspection of the overlap in the 95% confidence limits supports this interpretation as well.

As can be seen from Table 1 and Figure 2, cost savings or cost offset resulted from reduction in the number of patients who developed serious outcomes, not from shorter hospital stays when outcomes occurred. For most outcome groups, the average cost per patient increased with the addition of palifermin. However, far fewer patients on the palifermin arm were in the most costly outcome groups (those with multiple adverse outcomes) than on the placebo arm (29 [27%] and 60 [57%], respectively; $P < .001$). Similarly, 13 (12%) patients on the palifermin treatment arm had none of the adverse OM outcomes (the lowest cost group) compared with only 3 (3%) on the placebo arm ($P = .02$).

Our results were robust to sensitivity analyses using best and worst case scenarios as well as plausible values of hypothetic outpatient costs. In the best-case scenario (using the upper 95% confidence limit for mean cost), there was an estimated savings of $5,103 per patient treated with palifermin. In the worst-case scenario (using the lower 95% confidence limit for mean cost of hospitalization), palifermin therapy was associated with savings of $2,090 per patient. Using hypothetic outpatient costs to compute a total cost, nonsignificant savings were observed across the entire range of outpatient per diem costs when these were computed as a percentage of inpatient costs (Table 4). Using a standard per diem cost for every patient, nonsignificant savings were observed with palifermin for all plausible values of outpatient per diem cost. Only when outpatient per diem costs approached $3,000, a value higher than inpatient costs for >50% of patients on the trial, was a nonsignificant excess cost observed.

DISCUSSION

Cytotoxic therapies induce a damaging sequence of biologic events that prompt inflammation and ulceration of the epithelial mucosa [15]. As OM progresses, confluent lesions erupt and expand with bacterial colonization and produce considerable toxicity and pain. Injury to the oral mucosa provides a portal through which pathogens can enter the bloodstream and may lead to serious and potentially fatal infections, especially during periods of myelosuppression. In the presence of neutropenia, high-grade mucositis may predispose patients to bacteremia [2,7,16].

Oral mucositis impedes nutrient intake because eating and drinking become difficult or impossible for patients with high grades of the condition [15,17]. Fluid replacement therapy, liquid diets, and TPN are significantly more common during episodes of OM and further compound hospital costs. In a retrospective, random sample of 599 patients with solid tumors and lymphoma who developed chemotherapy-induced myelosuppression, the investigators identified a 10-fold increase in utilization of TPN, hydration, and use of opioids and a 2-fold increase in emergency room visits for patients who experienced high grades of OM. Grades 3 and 4 OM were associated with incremental costs of over $5,565 per chemotherapy cycle [7].

Oral mucositis is especially burdensome to patients who undergo HSCT and may affect as many as

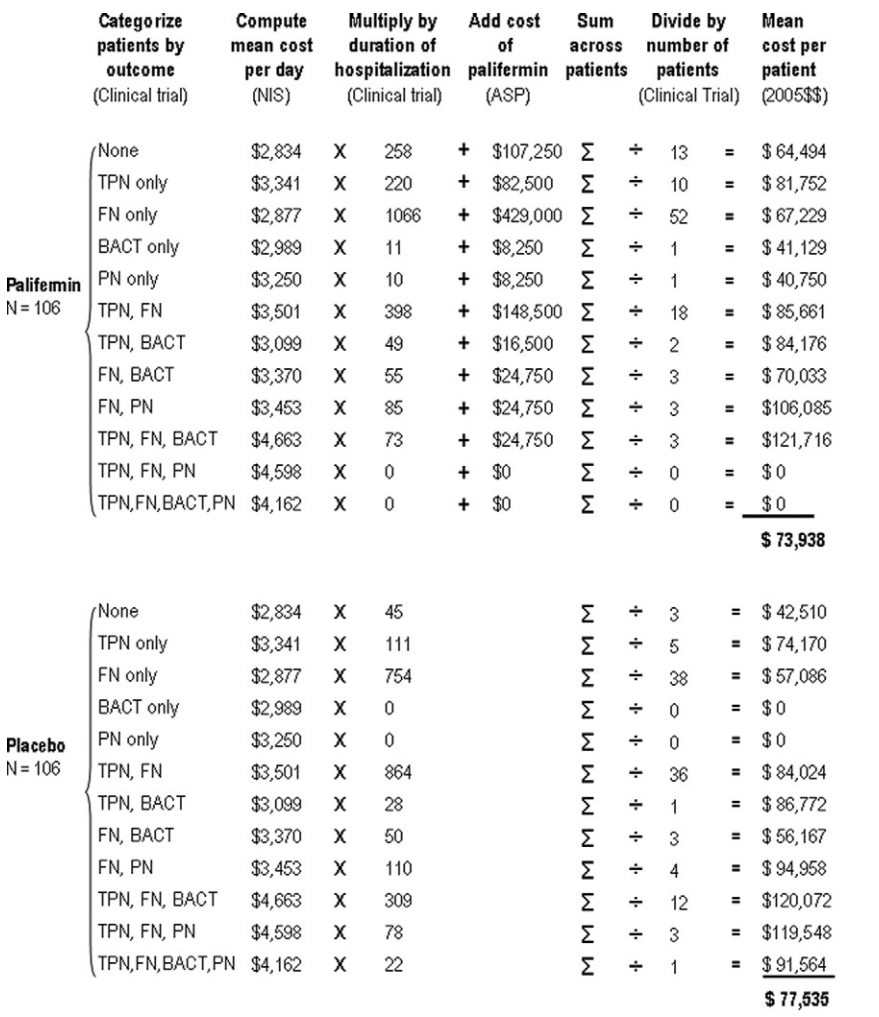

Figure 2. Cost estimates for the base-case scenario.

75% of all stem cell recipients [3-6]. In this population, oral mucositis is typically seen in association with increased risks of bleeding, fatigue, serious infection, and increased use of TPN, antibiotics, and pain medication [2,15-17]. These complications can increase costs considerably.

Although there have been agents available for many years to prevent other side effects of antineoplastic therapies, such as nausea and vomiting, diarrhea, anemia, and neutropenia, OM was historically treated symptomatically. Conventional therapies, including a variety of rinses, topical anesthetics, and

Table 4. *Comparison of Hypothetical Total Costs Over 35 Days*

Outpatient per Diem Cost	Palifermin Mean Cost* (95% CI)	Placebo Mean Cost* (95% CI)	Difference Palifermin-Placebo
% of inpatient cost			
10%	**$78,273 ($73,787-$82,760)**	**$81,781 ($75,573-$87,989)**	**−$3,508**
50%	**$95,614 ($92,281-$98,946)**	**$98,767 ($93,940-$103,592)**	**−$3,153**
75%	**$106,451 ($103,788-$109,115)**	**$109,381 ($104,933-$113,830)**	**−$2,930**
90%	**$112,954 ($110,463-$115,445)**	**$115,751 ($111,697-$119,804)**	**−$2,797**
Hypothetical standard cost per patient			
$500	**$80,967 ($76,807-$85,126)**	**$83,945 ($78,088-$89,803)**	**−$2,978**
$1000	**$87,995 ($84,382-$91,608)**	**$90,345 ($85,114-$95,597)**	**−$2,361**
$2000	**$102,051 ($99,674-$104,429)**	**$103,176 ($99,349-$107,004)**	**−$1,125**
$2500	**$109,080 ($107,053-$111,107)**	**$109,587 ($106,153-$113,020)**	**−$507**
$3000	**$116,108 ($114,340-$117,877)**	**$115,997 ($113,030-$118,964)**	**+$111**

*Mean cost = estimated inpatient cost + hypothetical outpatient cost for the 35-day observation period.

mucosal coating agents have been used, but have demonstrated limited to no meaningful efficacy [1,18,19]. However, the introduction of palifermin may change the oral mucositis therapeutic landscape. Palifermin's effectiveness in reducing the incidence and duration of severe OM and its clinically important outcomes promises new opportunities for intervening in the course of this serious condition. However, palifermin's clinical potential comes at a considerable price, currently $8,250 per patient in the bone marrow transplant setting. This additional cost may be justified based solely on palifermin's effectiveness, which represents a major clinical and quality of life improvement. However, the additional cost would certainly be justified if it were offset by cost savings resulting from fewer adverse outcomes of mucositis. The purpose of this study was to estimate the additional cost or cost savings of palifermin prophylaxis.

In the clinical trial population, use of palifermin was associated with an estimated savings in hospital costs of $3,595 per patient after accounting for the additional price of the drug. This observation was robust in multiple sensitivity analyses. However, the difference in mean costs was not statistically significant and there was large overlap in the 95% confidence limits. These findings suggest that although analysis in the trial population showed modest savings, use of palifermin would generally be considered cost-neutral. The acquisition cost is likely offset by reduced hospitalization, but significant cost savings may not occur. We also showed that the acquisition of cost of palifermin was offset as a result of a reduction in the frequency of adverse outcomes, particularly from significantly lower utilization of TPN, a costly intervention. From both clinical and economic perspectives, use of palifermin seems to be justified among patients similar in risk of OM to the clinical trial population.

These results should be interpreted in the light of a number of limitations to this analysis. First, cost data were unavailable for the patients in the clinical trial, making it necessary to use costs from patients in a separate database. These costs are nationally representative, and thus widely generalizable. However, they are not specific to the patients in the trial. Second, in consideration of the information available in the NIS, we assumed that charges were evenly distributed across the entire hospital stay and calculated the per diem costs accordingly. This assumption may introduce bias. If charges are highest in the first few days of hospitalization, then costs for discharges with longer lengths of stays may be over estimated. Because the placebo group had longer lengths of stay, this assumption could have led to overestimation of placebo costs and overestimation of the cost savings of palifermin. In contrast, if charges are higher during the later days of hospitalization when adverse subsequent outcomes have occurred, this assumption could lead to overestimation of costs in patients with short hospitalizations and few adverse outcomes (ie, the palifermin patients). It is impossible to determine the direction or magnitude of this bias with the available data.

Third, our analysis considered the effectiveness of palifermin only in terms of reduced cost of hospitalization. This strategy has the advantage of providing affordability information to providers who often receive payments for bone marrow transplantation (BMT) on a capitated basis. The disadvantage of taking the provider's perspective is that significant improvements in quality of life are not accounted for in the analysis. Because OM significantly compromises the quality of life of BMT recipients, this is an important concern. In the clinical trial, the worst grade of mucositis was significantly less frequent among those who received palifermin (20% versus 62%, $P < .001$) [8]. The median scores for soreness of the mouth and throat were significantly lower (lower scores indicate less pain) in the palifermin group than the placebo group [8,20]. Patients treated with palifermin had significantly higher scores (higher scores indicate better functioning) for physical and functional well-being categories of the Functional Assessment of Cancer Therapy than those patients receiving placebo [8]. These findings illustrate the impact of palifermin use on quality of life; failure to account for that impact leads to underestimation of the benefits of palifermin.

It is prudent to carefully consider the clinical setting when interpreting our results. In other BMT settings, particularly those without TBI, the cost profile may not be as favorable as shown in this population. The clinical findings of the original trial were recently confirmed in a nonrandomized study of patients who received BMT without TBI [10]. Although this study also showed a significantly shorter duration of hospitalization compared with historic controls, no economic analyses were performed. Even in the same BMT setting, our best- and worst-case scenarios show that a more or less favorable profile may be observed in some hospitals, with plausible values ranging between savings of $2,090 and $5,103. Furthermore, although the clinical and quality of life improvements increase the overall value of palifermin in this population, they may vary in other BMT settings as well.

In summary, previous trials have demonstrated a significant decrease in clinically important and costly outcomes of mucositis with palifermin use and reduced duration of hospitalization [8,9]. We have shown that these reductions may offset the acquisition cost of the drug in patients with hematologic malignancies who undergo SCT after TBI. The economic profile in other transplant populations will be affected by a number of factors including transplant type, mucotoxicity of treatment regimen, and patient popula-

tion. The economic and clinical impact of palifermin in these settings warrants further investigation.

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